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Droughts and Water Markets

California and other parts of the West are facing extreme drought conditions. After four consecutive drought years, water storage is at the lowest level in recorded history, and despite recent rains, the prospects for normal water supplies remain bleak.

In response to the impending shortages, state agencies and regional water districts have begun making plans to intensify water conservation and to restrict use. Agricultural customers of the State Water Project were told they will be cut off completely this year, while the federal system is considering 75 percent reductions in deliveries. The governor, state Water Resources Control Board (SWRCB), and the individual water districts all are working on plans to limit consumption.

In addition to these responses by water providers, the drought has raised interest in water markets. A growing number of economists and business publications have begun exploring the feasibility and desirability of allowing markets to handle most water allocations. In this *Letter,* the case for water markets is examined. Particularly in drought years, water markets could reduce the burden of cutting back on water use for residents of the state.

The current setting

The California water system is complex, in both physical and regulatory terms. Water is transferred from the northern part of the state to the central valley farmers and coastal urban areas through a sophisticated network of dams and canals. Water generally is allocated according to historical rights, with the rights often attached to specific tracts of land. Water rights, however, are not like rights to most commodities. According to state water law, the state owns the water: water rights simply give people the right to use the water, not sell it.

If water districts have surplus water, they can sell it to other water districts, but only by incurring high transactions costs imposed by current water policies. The local water district must first ensure that the holders of junior rights to the water do not wish to exercise them. Then the SWRCB must be convinced that the transfer does not cause adverse environmental or third-party effects (such as reducing runoff that would otherwise be used by someone else). Other agencies, including the state Department of Fish and Game, the U.S. Bureau of Reclamation, and the Environmental Protection Agency, also may place preconditions on the transfer or require satisfaction as to the potential effects. In general, therefore, these transactions costs make many transfers too costly to undertake.

These limits on trading result in prices that do not signal the value of the water. Prices charged by the federally managed Central Valley Project (CVP) are as low as $8 per acre foot to some farmers in the San Joaquin valley. These prices are based on the amortized cost of constructing the dams in the system. Interest on the construction costs is not charged, however, which means that these prices do not even cover the cost of construction, let alone the market value of the water. In this and other cases, prices do not reflect the opportunity cost of the water.

Limits on resale of water result in large inefficiencies. Urban consumers pay upwards of $200 per acre foot, and growing needs have forced urban water districts to consider building desalinization plants that will cost over $2,000 per acre foot—more than 200 times the price paid by some CVP customers. Instead of selling water to consumers who are willing to pay higher prices, existing water policy encourages farmers to use their full allotments at the low, subsidized price.

Because of this policy, we find that 40 percent of the state's water is used to grow rice, alfalfa, cotton, and pasture, even though these crops altogether account for only about 0.2 percent of total state income.

Regulatory response to drought

During periods of drought, policymakers are forced to set water allocations to accommodate

lower supplies. These allocations inevitably raise questions about fair distributions of water supplies. Agricultural users are heavily restricted, and urban users face potential fines for excessive use.

Policymakers attempt to determine restricted allocations in ways that minimize the burden on water users. Water to urban users is typically based on family size, historical use, or other characteristics that are argued to result in fair burden-sharing. Agricultural users are cut back more than urban users, while water used for long-term crops, such as tree crops or grapes, is restricted less heavily than those for field crops.

Such allocations, while designed to be as fair as possible, could be improved by allowing trading. Trading between customers makes it is possible for individuals to change the initial allocation when such changes are mutually beneficial.

Markets can help

Economic theory suggests that markets provide a mechanism to achieve these mutually advantageous trades at minimum cost. A water market would allow consumers to adjust their initial allocations to compensate for special needs or capabilities to reduce consumption. Prices offer a direct measure of the value of water to all potential consumers. In response to rising prices, consumers who can reduce their consumption do so—and are compensated by payments from those who want more than their initial allocation.

Once water users face the true cost of water—that is, the price others would be willing to pay for it—they have financial incentives to put water to its most valuable use. Water priced in deregulated markets gives direct signals to the farmer about crops to plant and irrigation equipment to purchase. Moreover, farmers growing low-valued, water-intensive crops may find it worthwhile to hold land fallow during drought years and reduce their water consumption.

For households, water markets would allow users to weigh the costs and benefits of water use, adjusting their consumption to match their specific situations. For example, a 300 gallon per day limit on all households ignores the fact that some people, such as apartment dwellers or condominium owners, may use far less, while others, with expensive landscaping, may wish, at some price, to protect some of those investments. As prices rise, households without large watering needs are encouraged to cut back their consumption to reduce their water bills.

Fairness

Allowing individuals to trade initial allocations in markets could improve the fairness of the initial allocation. For example, even with reduced deliveries, farmers in some areas may find it more profitable to sell their water allotment to urban users or to other farmers than to use it on their own land. Moreover, different farms have different abilities to reduce consumption, given the crops they grow and the equipment they have in place.

Similarly, trading could improve fairness in urban use. If urban users could voluntarily sell their water, or buy that of their neighbors, they could make informed decisions about water use, including landscaping and water conservation investments. Factors that lead to differential use by different households and that are not easily observed by those setting the initial allocation could be accounted for by such trading.

In all, allowing trading to occur unambiguously improves fairness because parties that choose to trade do so voluntarily. At worst, no trading would occur if no mutually advantageous exchanges can be reached.

Feasibility

Moving in the direction of water markets is not a trivial exercise. Many issues would have to be resolved including the establishment of rights, compensation to potential losers, and developing institutions to facilitate the transfers. While these issues are complicated, they can be surmounted.

Fairness is the major stumbling block to creating a deregulated water market. Because water currently is underpriced, assignment of water rights that can be sold confers potential windfall gains to the rights holders. Moreover, those who currently purchase water at below market prices would face higher prices, which in the case of agriculture, could result in decreased land values.

In theory, improved efficiency in allocation would yield gains to society that could be used to compensate those who lost. The government could impose windfall profits taxes on the new rights holders, lost value in real estate could be

compensated, and other schemes could be devised to protect those facing potential harm.

Consider one approach where water rights are granted to the agencies that constructed the dams, and, at the extreme, existing users lose their water rights. Because the value of the water rights is capitalized in the value of the land, removal of those rights would decrease the value of that land. This loss can be measured, however, and the water district granted the ownership right of the water can be required to use revenues from water sales to compensate the landowner for any loss. Unlike most cases, where the harm to one group from a transfer of rights cannot be measured, water markets offer direct ways to measure and compensate for the harm.

Nevertheless, devising compensation schemes will inevitably be imperfect and may cause transitional problems. Some former rights holders will be forced to make significant changes in farming practices, and some areas may fall out of agricultural production. Designing policies to tax windfall gains and redistribute those revenues inherently requires controversial judgements.

For the purpose of addressing the drought, this problem may be less critical. The current policy has defined property rights explicitly through the granting of quotas. Whether or not that initial allocation is the best possible allocation, trading can be allowed to improve well-being from that starting point.

And a market may not be difficult to establish. For example, a water district could issue vouchers to consumers for their entitlement of water and charge them the normal fee for that quantity of water. Those vouchers could be traded by individuals through financial institutions, with the price of the voucher determining the cost of water. Consumers would have to have a voucher for each unit of water they consumed, so as consumption rose, the price of a voucher would rise, and consumption would be discouraged. Under this scheme, those who use less water would be net sellers of vouchers, while those above quota would be net buyers.

Schemes such as this have been used in other situations successfully, such as in the use of marketable discharge permits, in which potential polluters buy the right to discharge pollutants from other participants. As long as consumers can monitor their use and have price information provided by a market, they can choose the strategy that minimizes the burden of reduced water supplies.

Oil and natural gas industries also provide some insights into the potential operational feasibility of a water market. Those industries now are largely deregulated, and are capable of delivering products from the field to refineries or natural gas processing plants through a complex web of pipelines, through the distribution network of the local utilities or oil suppliers, to final consumers. Electric utilities routinely sell surplus bulk power from one region to another, in the process using transmission lines owned by other utilities. Thus, the complexity of other, similarly structured industries has been managed easily in a market system. Moreover, such markets flourish even when portions of the system operate as regulated monopolies, such as pipeline and electric utility distribution companies.

In the short term, limitations on the system's interconnection could be important. But in a deregulated market, interconnecting infrastructure—canals or pipelines—would be expected to be developed by the private sector where such investments are warranted.

Conclusion

Addressing water allocation problems becomes increasingly important during droughts when water supplies are limited. Most allocation schemes could benefit from the introduction of markets to allow trading among individuals. By doing so, the flexibility and creativity that individual water users would employ to adjust consumption can be fully realized.

Over the longer term, deregulated water markets could offer an automatic mechanism to solve the allocation problem in the least- cost way. As supplies shrink, prices would rise. And those who can most easily reduce their consumption will do so. While implementation will require careful planning, other industries have provided examples that could prove useful in that design.

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